BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA

DOCKET NO. 2019-224-E
DOCKET NO. 2019-225-E

In the Matter of:	)	
	)	
South Carolina Energy Freedom Act (House Bill 3659) Proceeding Related to S.C. Code Ann. Section 58-37-40 and Integrated Resource Plans for Duke Energy Carolinas, LLC and Duke Energy Progress, LLC	)))))))	**REBUTTAL TESTIMONY OF DEWEY S. ROBERTS II ON BEHALF OF DUKE ENERGY CAROLINAS, LLC AND DUKE ENERGY PROGRESS, LLC**

I. INTRODUCTION AND SUMMARY

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Dewey S. Roberts II (Sammy) and my business address is 3401 Hillsborough Street, Raleigh, North Carolina.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Duke Energy as General Manager, Transmission Planning and Operations Strategy.

Q. DID YOU PREVIOUSLY FILE DIRECT TESTIMONY IN THIS PROCEEDING?

A. Yes.

Q. ARE YOU INCLUDING ANY EXHIBITS IN SUPPORT OF YOUR REBUTTAL TESTIMONY?

A. Yes. I am providing a discovery request from Vote Solar Witness Tyler Fitch as Roberts Rebuttal Exhibit 1.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY IN THIS PROCEEDING?

A. My rebuttal testimony responds to arguments and testimony put forward by Carolinas Clean Energy Business Association[1] ("CCEBA") Witness Kevin Lucas and Vote Solar Witness Tyler Fitch challenging certain aspects of Duke Energy Carolinas, LLC's ("DEC") and Duke Energy Progress, LLC's ("DEP" and, together with DEC, the "Companies") 2020 Integrated Resource Plans ("2020 IRPs"). Neither of these witnesses presents the

[1] The CCEBA testimony to which I am responding was filed originally by the South Carolina Solar Business Alliance, Inc. ("SCSBA"). On March 10, 2021, the Commission issued Order No. 2021-167 and granted a Motion to substitute CCEBA for SCSBA as party of record in these dockets.

crucial level of understanding of what it actually takes to plan for and maintain reliability with power system operations. In contrast, my rebuttal testimony addresses my real world experience with DEC and DEP power system operations and the fundamental importance of ensuring "power supply reliability" as the Companies plan to significantly transition their fleets, including integrating more solar generation into the DEC and DEP Balancing Authorities ("BA") over the next 15 year planning period, as presented in the Companies' 2020 IRPs.

Q. PLEASE SUMMARIZE YOUR REBUTTAL TESTIMONY.

A. First, my rebuttal testimony notes that no intervenor witness adequately addresses operational risk associated with their recommendations. In order to fill in the blanks, my rebuttal testimony explains the impact of their recommendations on the Companies' operations of the DEC and DEP BAs, as well as the Companies' growing experience with the operational concerns, reliability risks, and North American Electric Reliability Corp. ("NERC") compliance challenges associated with the rapid and ongoing deployment of solar facilities that are continuing to interconnect with and inject energy on a variable and intermittent basis into the Companies' systems. Next, my rebuttal testimony addresses the mandatory and enforceable NERC Reliability Standards that were ignored by other witnesses in this proceeding and explains that the DEC and DEP BA must each plan for and maintain adequate power supply resources to ensure compliance with the NERC BAL Standards on a real-time basis.

My rebuttal testimony then addresses CCEBA Witness Lucas's testimony emphasizing the "stranded asset cost risk" associated with incremental natural gas-fired generating capacity included the Companies' 2020 IRPs base plan resource portfolios and highlights that he fails to acknowledge or to fairly address operational risks associated with other generating technologies and fails to explain how his recommendations take into account mandatory and enforceable NERC Reliability Standard requirements. I then highlight the operational risks associated with Witness Lucas's recommendation that the Companies should plan to more heavily rely upon intermittent and variable solar coupled with 2-hour storage, which, from my perspective as a system operator, is flawed and does not promote reliable system operations nor enable compliance with NERC Reliability Standards.

Finally, I respond to Vote Solar Witness Fitch's testimony, specifically his Exhibit TF-2 Carbon Stranding: Climate Risk and Stranded Assets in Duke's Integrated Resource Plans ("Carbon Stranding and Climate Risk Report"), where he tries to relate climate risks and stranded assets to the IRPs' Base Case with Carbon Policy portfolio. Witness Fitch does extensively discuss risks in this section of his Carbon Stranding and Climate Risk Report; however, he also fails to address the Companies' obligation to manage operational risks and to meet NERC Reliability Standard requirements in order to provide reliable electric service to our customers.

Witness Fitch ignores firm, dispatchable gas generation's critical role in effectively managing those risks and allowing the Companies to continue to provide reliable electric service to our customers. His recommendation that DEC and DEP avoid planning for gas generation as an incremental resource is a dangerous recommendation and, if adopted, would create risks for the Companies and customers. Indeed, just days ago, the NERC President and CEO, Mr. James Robb, emphasized for the United States Senate Committee on Energy and Natural Resources ("U.S. Senate E&NR Committee") the critical role that gas generation has today for ensuring the reliability, resiliency, and affordability of electric service in the United States and, going forward, will fulfill to reliably integrate more solar and wind generation resources as we transition to lower CO_2 emissions. Robb explained:

> Natural gas is essential to a reliable transition. As variable resources continue to replace other generation sources, natural gas ***will remain essential to reliability***. In many areas, natural gas-fueled generation is needed to meet energy demand during shoulder periods between times of high and low renewable energy availability. And on a daily basis in areas with significant solar generation, the ***mismatch between the solar generation peak and the electric load peak necessitates a very flexible generation resource to fill the gap. Natural gas generation is best positioned to play that role***. The criticality of natural gas as the "fuel that keeps the lights on" will remain unless or until very large-scale battery deployments are feasible or an alternative flexible fuel such as hydrogen can be developed.[2]

In addition, I will discuss the Companies' review of Witness Fitch's work papers and modeling data used to perform his analysis, as reflected in the Carbon Stranding and Climate Risk Report. This review revealed poor assumptions, flawed model construction, and incorrect inputs resulting in inaccurate analysis and conclusions that have no credible technical support and, therefore, should not be given any weight by the Commission in these proceedings.

II. COMPANIES' RESPONSIBILITY AS NERC BALANCING AUTHORITIES TO ENSURE POWER SUPPLY RELIABILITY

Q. IN REVIEWING THE COMPANIES' 2020 IRPs, IS POWER SUPPLY RELIABILITY AN IMPORTANT CONSIDERATION?

A. Yes. The Companies have the public service obligation to plan and operate their generating fleets and transmission and distribution systems to provide reliable power system

[2] James R. Robb, North American Electric Reliability Corporation, Testimony Before United States Senate Committee on Energy and Natural Resources, Full Committee Hearing On The Reliability, Resiliency, And Affordability Of Electric Service, at 9, 10 (March 11, 2021) (emphasis added), *available at* https://www.energy.senate.gov/services/files/EB1D7E02-BC93-4DFF-A6A9-002341DA34CF.

operations to our customers 24 hours per day, 7 days per week, 52 weeks per year. In the resource-planning context, under Act 62, ensuring "power supply reliability" is one of the factors the Commission must consider in reviewing the Companies' 2020 IRPs.[3] From my position as a system operator, compliance with mandatory NERC Reliability Standards and proactively ensuring "resource assurance" is foundational to ensuring power supply reliability and is also a critically important consideration reviewing the Companies' 2020 IRPs and alternative planning recommendations offered by intervenors.

Q. DID ANY INTERVENOR ADEQUATELY ADDRESS NERC RELIABILITY STANDARDS OR FOCUS ON ENSURING RELIABLE SYSTEM OPERATIONS IN THE FUTURE?

A. No. In fact, only CCEBA Witness Arne Olson's Direct Testimony Exhibit AO-2 and ORS Witness Anthony Sandonato's Direct Testimony Exhibit AMS-1 and Exhibit AMS-2 ("ORS Reports") refer to "NERC" and neither present any focused consideration or analysis of the Companies' obligations to comply with mandatory NERC Reliability Standards today as well as under future resource planning scenarios. Witness Olson's Direct Testimony Exhibit AO-2, page 32, refers to Astrapé aggregating historical outages from the NERC Generating Availability Data System ("GADS"). The NERC GADS is not associated with NERC Reliability Standards. The ORS Reports do acknowledge that the Southeastern Electric Reliability Corporation ("SERC") audits DEC and DEP every 3 years to ensure compliance with NERC Standards.[4]

[3] S.C. Code Ann. § 58-37-40(C)(2)(d).
[4] ORS Sandonato Direct, Exhibit AMS-1 at 98, Exhibit AMS-2 at 97.

Q. PLEASE EXPLAIN WHY THESE CONSIDERATIONS ARE CRITICALLY IMPORTANT FOR RESOURCE PLANNING.

A. The Companies' 2020 IRPs take unprecedented steps to analyze and plan for integrating solar and other clean energy technologies during the IRPs' 15-year planning period, as well as chart multiple paths towards Duke Energy's corporate goals of getting to net-zero emissions by 2050. As DEC/DEP Witness Dawn Santoianni explains, the Companies' analysis suggests that they can achieve significant reductions in carbon emissions by 2030 with the technology that exists today; however, getting to net-zero emissions by 2050 will require innovation and new technologies. Ensuring ongoing system reliability and compliance with mandatory NERC Reliability Standards in the face of this challenging transition is of significant importance for the Companies and for our customers and is non-negotiable. We should remind ourselves of the very reason for NERC Reliability Standards becoming mandatory and enforceable through the Energy Policy Act of 2005. NERC and the Federal Energy Regulatory Commission ("FERC") established the mandatory and enforceable Reliability Standards in the aftermath of a massive blackout on August 14, 2003 affecting an area with an estimated 50 million people and 61,800 megawatts ("MW") of electric load in the states of Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, New Jersey and the Canadian province of Ontario. The estimated costs of the blackout ranged between \$4 billion and \$10 billion.[5] It was determined that the blackout resulted from a failure to follow existing reliability standards.[6]

[5] U.S.-Canada Power System Outage Task Force, Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations, at 1 (April 2004), *available at* https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf.

[6] NERC, August 2003 Northeast Blackout, at 6, *available at* https://www.nerc.com/docs/docs/blackout/ISPE%20Annual%20Conf %20%20August%2014%20Blackout%20EPA%20of%202005.pdf.

Q. HAVE OTHER STATE COMMISSIONS RECENTLY RECOGNIZED THE CRITICAL IMPORTANCE OF FOCUSING ON ENSURING LONG-TERM SYSTEM RELIABILITY IN RESOURCE PLANNING?

A. Yes. The State Corporation Commission of Virginia ("VSCC") recently emphasized this important issue in its February 1, 2021 Order ruling on Dominion Energy Virginia's IRP. The VSCC found that

> [t]he large-scale transition from traditional fossil fuel generation to cleaner intermittent renewable generation raises potential reliability concerns that must be carefully considered and addressed. . . . The [VSCC] takes very seriously its obligation to take necessary actions to protect the security and reliability of the electric system, upon which many aspects of modem life depend.[7]

The Companies similarly take seriously their responsibilities to protect the security and reliability of the electric system, and the fact that the intervenors testimony does not acknowledge, much less mention, these important issues is notable.

Q. IS SOUTH CAROLINA ALSO PROACTIVELY ADDRESSING RELIABILITY AND RESILIENCY ISSUES?

A. Yes. It is my understanding that upon the request of the Governor, ORS sought and the Commission approved a docket to explore the reliability and resiliency of the grid and resources serving South Carolina customers. The stated purpose of the docket is to require utilities to describe "measures that have been, or will be taken, to: (1) mitigate the negative impacts of ice storms and other dangerous weather conditions to the provision of safe and reliable utility service; and (2) ensure peak customer demands on the utility system can be

[7] *In re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et seq* Final Order, at 8, VSCC CASE NO. PUR-2020-00035 (Feb. 1, 2021).

met during extreme weather scenarios."[8] The docket requires utilities to assess, among other things, threats to utility service, vulnerabilities, and resiliency solutions.[9]

Q. PLEASE DESCRIBE DEC'S AND DEP'S RESPONSIBILITIES RELATED TO NERC RELIABILITY STANDARDS.

A. As mentioned previously, The Energy Policy Act of 2005, as implemented by FERC under Section 215(c) of the Federal Power Act, established NERC as the Electric Reliability Organization to develop and enforce reliability standards. Any violations of NERC Reliability Standard requirements are subject to a civil penalty of up to $1,000,000 per violation for each day that it continues.

DEC and DEP have responsibilities to perform various NERC reliability functions. As Generator Owners and Generator Operators, DEC and DEP own, maintain, and operate generating units to supply reliable and affordable electricity to approximately 4 million customers in South Carolina and North Carolina. As a transmission owner and transmission operator, DEC and DEP own, maintain, and operate transmission facilities in South Carolina and North Carolina, and are responsible for operating their transmission systems in a reliable manner in compliance with applicable NERC Reliability Standards. As independent BAs, the Companies must plan for and balance generating resources and power deliveries with customer demand for electricity in real-time to avoid causing adverse power flow and/or frequency issues that could lead to instability or separation of the power system.

[8] *Order Establishing Docket and Guidelines by Utilities and Other Interested Stakeholders Regarding Mitigation of Impact of Threats to Safe and Reliable Utility Service*, Order No. 2021-163, at 1, Docket No. 2021-66-A (Mar. 10, 2021).
[9] *Id*. at 1-2.

In my roles with the Companies, I have been responsible for reliable system operations and compliance with NERC Reliability Standards related to the Companies' BAs and Transmission Operator functions.

Q. PLEASE EXPLAIN THE COMPANIES' ROLES AS NERC BALANCING AUTHORITIES FOR THEIR BALANCING AUTHORITY AREAS.

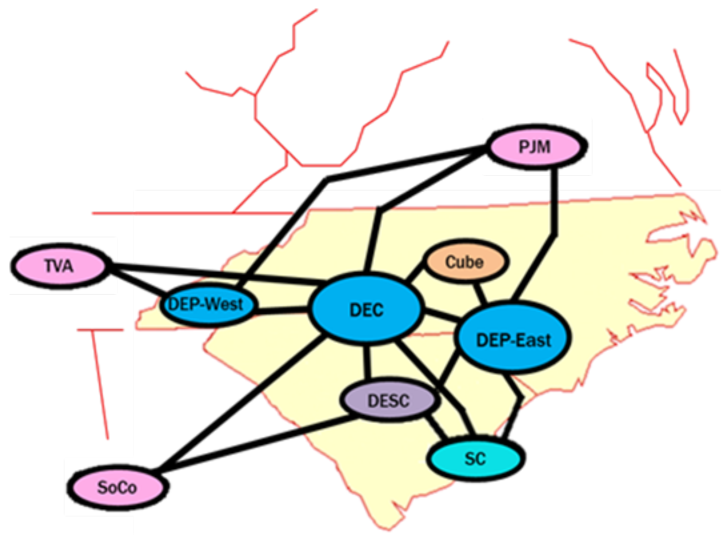
A. DEP and DEC are each independent registered NERC Balancing Authorities or "BAs" responsible for maintaining reliable operations on their systems, as well as managing power flows between their systems and other utility systems.[10] As highlighted in the Companies' 2020 IRPs, DEC operates a fleet of approximately 22,333 MW (winter rating) of capacity resources (includes Demand Side Management ("DSM") capability) to serve customers' energy needs on a 21,620 MW peak load system, while DEP operates approximately 17,111 MW (winter rating) of capacity resources (includes DSM capability) to serve its customers' energy needs on a 15,718 MW peak load system.

The DEC and DEP BAs control their respective generating fleets of "network resources" to meet system loads, as well as to maintain compliance with NERC Reliability Standards applicable to each BA. This responsibility includes maintaining interchange schedules between the DEP BA and the DEC BA, as well as other neighboring BAs, such as the Southern Company, Dominion Energy South Carolina and South Carolina Public Service Authority BAs to the south, the Tennessee Valley Authority BA to the west, and the PJM Interconnection BA to the north. My Figure 1 depicts the interconnected nature

[10] The Balancing Authority is defined by NERC as "[t]he responsible entity that integrates resource plans ahead of time, maintains Demand and resource balance within a Balancing Authority Area, and supports Interconnection frequency in real time." Accessible at https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf (last visited Mach 17, 2021).

of the Companies' BAs with other neighboring BAs in the SERC region.

Roberts Rebuttal Figure 1: DEC, DEP and Neighboring Balancing Authorities



DEC, DEP and Neighboring Balancing Authorities (BAs)

Q. PLEASE EXPLAIN THE IMPORTANCE OF NERC'S BAL STANDARDS AS THEY APPLY TO MAINTAINING SYSTEM RELIABILITY.

A. Each BA is responsible for independently complying with its mandatory NERC obligations, including providing its share of frequency support for the Eastern Interconnection, and by definition, maintaining demand and resource balance within its Balancing Authority Area. A BA must purposefully plan and dispatch its generating fleet to ensure compliance with NERC BAL Standards and cannot rely on unscheduled power flow from neighboring BAs to meet its obligation to maintain demand and resource balance and thus, the NERC BAL Standards are designed to discourage and in effect, prohibit this behavior. Together, the BAL-001, BAL-002, and BAL-003 Standards are designed to enhance the reliability of each Interconnection by maintaining frequency within predefined limits every 30 minutes under all conditions, and effectively mandate every BA to balance generation resources to load demand within the BA during each 30-minute reporting period.

The BAL Standards are important Reliability Standards, because they regulate a BA's performance with respect to maintaining proper reserves to balance resources and demand in real time and to provide for proper frequency regulation within its operating boundary, to control a BA's impact on the reliability of neighboring BAs across the interchange tie lines and the regional Interconnection generally. Importantly, a BA's failure to comply with these mandatory NERC Reliability Standards could result in system emergencies and reliability failures, such as unscheduled power flows, unnecessary and automatic firm load shedding, or in a worst-case scenario, cascading outages across the Interconnection.

In summary, DEP and DEC, as NERC BAs, are each subject to mandatory NERC Reliability Standards, requiring the Companies to independently balance their respective systems and to provide reliable "firm native load service" to meet our customers' electricity needs. NERC's regulations make the Companies responsible for maintaining reliable system operations for our customers, and this reality is an underpinning of our 2020 IRPs.

Q. PLEASE EXPLAIN WHY "RESOURCE ASSURANCE" IS A CRITICAL CONCEPT FOR ENSURING NERC COMPLIANCE AND POWER SUPPLY RELIABILITY IN INTEGRATED RESOURCE PLANNING.

A. "Resource assurance" means proactively taking steps to ensure reliability of electric power resources or other alternatives that would provide confidence such that electric power interruptions are minimized to maintain reliable Bulk Power System performance during both normal operations and credible extreme events. Critical to maintaining reliable system operations and compliance with NERC's Reliability Standards is planning for resource adequacy and resource assurance with dependable and dispatchable capacity resources. Based upon my operational experience, an integrated resource plan that is not objectively developed and is biased towards resources for which resource assurance is subject to the sun shining or the wind blowing and does not plan for dependable and dispatchable generation to meet all reasonably-foreseeable contingencies is counter to resource assurance. As I describe in more detail later in my testimony, even coupled with storage, if the sun is not shining for consecutive days due to dense cloud cover or rain or if the panels are covered with ice and snow, this could result in little if any energy production from these resources to store.

Respectfully, I believe the Commission should weigh the Companies' view on operational realities very seriously, and that the Commission should be reluctant to force the Companies to adopt riskier resource plans that present reliability concerns given that NERC requires the Companies to maintain reliable system operations. In my opinion, it is not a good result if the Commission forces a planning scenario that we cannot support under NERC standards or that NERC could find fault with.

III. RESPONSE TO CCEBA WITNESS LUCAS

Q. WHY IS A FUNDAMENTAL UNDERSTANDING OF BAs AND THEIR RESPONSIBILITIES RELATED TO THE NERC RELIABILITY STANDARDS AND RESOURCE ASSURANCE IMPORTANT TO YOUR REBUTTAL TESTIMONY?

A. CCEBA Witness Lucas asserts that "Duke fails to present a robust risk analysis that would enable the Commission to determine if the proposed IRP is the most reasonable and prudent means of meeting the electrical utility's needs," and specifically argues that the Companies "fail[] to account for several fossil-fuel related risks[.]"[11] Based, in part, on this assessment, he then concludes that the Companies coal-fired generation can be retired, new gas generation can be avoided, and this retired coal generation and planned gas generation can instead be replaced with significant additions of new solar and 2-hour battery storage.[12]

Contrary to Witness Lucas's arguments, these alternative resource-planning recommendations would fundamentally change the Companies' generating fleets and introduce operational challenges and reliability risks that would need to be studied and planned for to ensure that power supply reliability and NERC compliance can be maintained. Operating the power system during this period of significant transition brings to mind the saying that the Companies are flying a plane while building it or, perhaps, redesigning, reengineering and rebuilding it. Understanding the NERC BAL standards aforementioned and what BAs must do to ensure compliance with these standards is imperative to understanding that Witness Lucas's argument is not sound and why it is necessary for the Commission to allow the Companies time to continue to model, analyze and study these complex new issues in order to prudently plan and operate our systems.

Q. IS IT FAIR TO SAY THAT WITNESS LUCAS FOCUSES ONLY ON WHAT HE PERCEIVES TO BE RISKS ASSOCIATED WITH FOSSIL GENERATION?

A. Yes. In the 73 times that Witness Lucas uses the term "risk' across his 111 pages of testimony and supporting Exhibits, he never addresses operational or reliability risks

[11] CCEBA Lucas Direct, at 4.
[12] CCEBA Lucas Direct, at 4, 7.

associated with solar and focuses only on perceived risks associated with fossil fueled generation.

Q. ARE THERE ALSO RELIABILITY AND OPERATIONAL RISKS ASSOCIATED WITH INTEGRATING SOLAR AND OTHER NON-FOSSIL FUEL TECHNOLOGIES?

A. Yes. As the Commission knows, the Companies are national leaders in terms of installed solar on their BAs, especially in DEP. Based on my extensive system operational experience in the Carolinas, there are growing operational and reliability risks with integrating variable and intermittent solar generation into the DEC and especially the DEP BAs that need to be considered to ensure resource assurance and power supply reliability is maintained for our customers.

Q. PLEASE DESCRIBE THE CHALLENGES THE DEP AND DEC SYSTEM OPERATORS ARE INCREASINGLY FACING BASED UPON YOUR EXPERIENCE INTEGRATING UTILITY-SCALE SOLAR INTO THE COMPANIES' SYSTEM OPERATIONS.

A. As the BA operator, DEP must balance the entire BA, and therefore, must balance for all installed solar capacity, whether interconnected directly to the South Carolina or North Carolina region of DEP's BA, or even to DEP's wholesale customers to whom DEP must also provide firm native load service. The system operators' core responsibility is to manage the independent DEP and DEC BAs, by balancing generation resources, unscheduled variable and intermittent energy injections from solar, and load demand in real-time in order to provide reliable firm native load service, maintaining compliance with mandatory Reliability Standards, and achieving reliable bulk electric system operations across the Eastern Interconnection.[13]

The level of installed solar injecting energy into the DEP and DEC BAs has rapidly increased over the past seven years due to state renewable energy policies and PURPA implementation. The majority of this solar has been developed in DEP, with over 3,000 MWs of installed solar interconnected and now injecting energy into the DEP system as of February 28, 2021. There is now also over 1,140 MWs of installed solar interconnected and injecting into the DEC system. An additional 922 MW and 767 MW are currently under construction in DEP and DEC respectively, with significant QF solar proposed to be developed in the future in both South Carolina and North Carolina. Installed utility-scale solar (plants 1MW_{AC} or greater) continues to grow with over 4,100 MW installed in the DEC and DEP BAs, and with over 9,300 MW requesting interconnection to be installed in the future.

Based on the Companies' growing operational experience maintaining essential reliability services[14] and operating the BAs in accordance with NERC's reliability requirements as significant growth of variable and intermittent solar has continued, the Companies have identified the following operating challenges and reliability risks associated with integrating significant levels of solar: (i) managing "unscheduled" and

[13] The system operators for each BA independently conduct a Security Constrained Unit Commitment of base-load and load-following assets, regulation resources, operating reserves, and spinning reserves, working together to plan for and to meet customers' energy needs in real time and to also ensure real-time frequency support and balancing is maintained.

[14] Essential reliability services include: (i) voltage support; (ii) system inertia; (iii) ramping; and (iv) frequency support. They are "essential" because they are critical to reliable BA operations and must be provided regardless of the BA's resource mix. Essential reliability services are provided by designated network and contingency resources that have synchronous, load-following response capabilities and are measured and monitored to comply with NERC requirements, so that operators and planners are aware of the changing characteristics of the BA, and can make informed decisions to operate the BA in a reliable manner.

"unconstrained" solar QF energy injections bounded by the Security Constrained Unit Commitment of reliable load-following service; (ii) managing the variability and intermittency of solar energy injections; (iii) managing the growing amounts of operationally excess energy injected by solar facilities, particular during the spring and fall periods and (iv) ensuring compliance with NERC Reliability Standards, specifically including the BAL standards.

Q. PLEASE DESCRIBE HOW THE DEP SYSTEM OPERATORS ARE MANAGING THE SIGNIFICANT ADDITIONAL GROWTH IN VARIABLE AND INTERMITTENT SOLAR?

A. Currently, the DEC and DEP BAs are continuing to experience significant growth of solar facilities. On blue-sky days, these facilities maximize their output and continue to inject energy into the BA during the mid-day load valley when system demand is at its lowest. The BAs cannot reduce online generation below their lowest reliable operating limit ("LROL") level, causing load-following system generation that is required for reliability to exceed the net system demand (actual load minus unscheduled/unconstrained solar QF energy), resulting in operationally excessive energy on the BA – *caused by operationally excessive solar QF installed capacity*. This issue occurs in DEP often, resulting in the system operator having to either take action in real time to (i) schedule the excess energy to flow off system, using non-firm transmission service; or (ii) if no sink BA or non-firm transmission service is available to absorb the excess energy, the DEP system operator must curtail solar output to maintain required regulating, load following generation on-line and remain compliant with NERC Reliability Standards.

Both of these options create potential real-time operating and reliability complexities and challenges. Looking ahead to 2022 and beyond, these challenges and risk will be amplified in both the DEC and DEP BAs, particularly in the DEP BA, as the quantity of installed solar, especially uncontrolled QF solar, capacity increases.

Q. PLEASE DESCRIBE HOW THE BA MAINTAINS REAL-TIME BALANCING OF DEMAND AND GENERATION AS VARIABLE QUANTITIES OF UNSCHEDULED AND UNCONSTRAINED SOLAR ENERGY IS INJECTED INTO AND WITHDRAWN FROM THE BA.

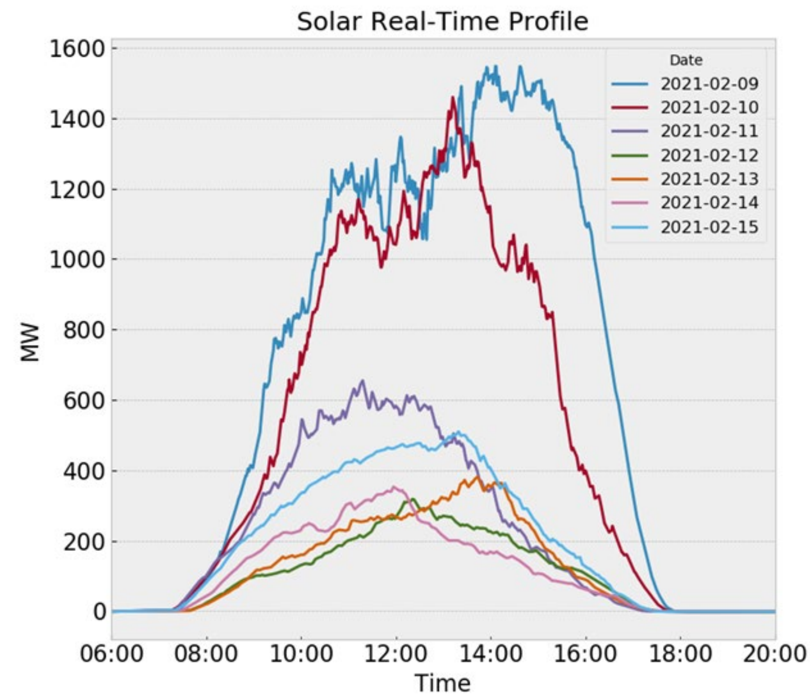
A. Solar generators, by their nature, deliver variable quantities (i.e., low forecast certainty) of unscheduled and unconstrained energy into the BAs throughout the day, and most commonly inject their peak outputs of energy during mid-day hours when the sun is normally providing highest irradiance. Irradiance is the amount of radiant energy or light energy per square meter of surface area of a solar panel.[15]

The Companies' recent experience is that that winter solar output for solar facilities in the Carolinas is especially challenging to plan for, and is not dependable day-ahead and even intra-hour unless a clear, blue-sky day is guaranteed. As seen in Figure 2, the irradiance or light energy across seven consecutive days in the DEP area during February 2021 was limited and thus solar output is not easily forecasted or dependable. Indeed, the capacity factor for these seven consecutive days was only 6.06% and for five consecutive days was only 3.44%. This compares with average capacity factor data for fixed tilt solar and single axis tracking solar in the DEP area of 14%-17% and 15%-16%, respectively, for

[15] NASA.gov, Solar Irradiance, https://www.nasa.gov/mission_pages/sdo/science/solar-irradiance.html (last visited Mar. 18, 2021).

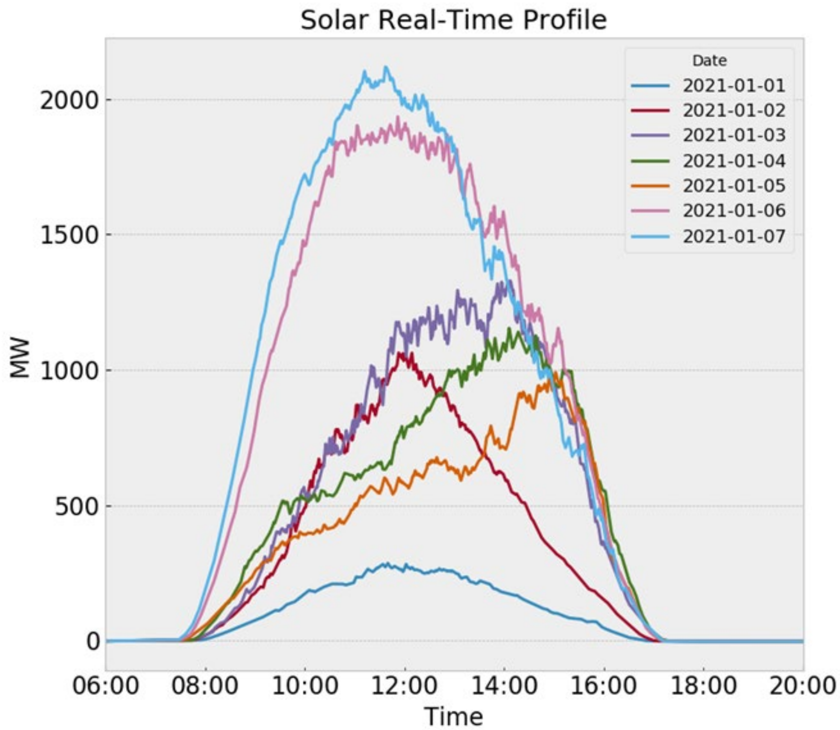
the winter months of January and February as compared with 22%-28% and 28% - 31%, respectively, for the summer months of June through August.

Roberts Rebuttal Figure 2: DEP Solar Profile 7-Day Period (Feb. 9 – Feb. 15, 2021)

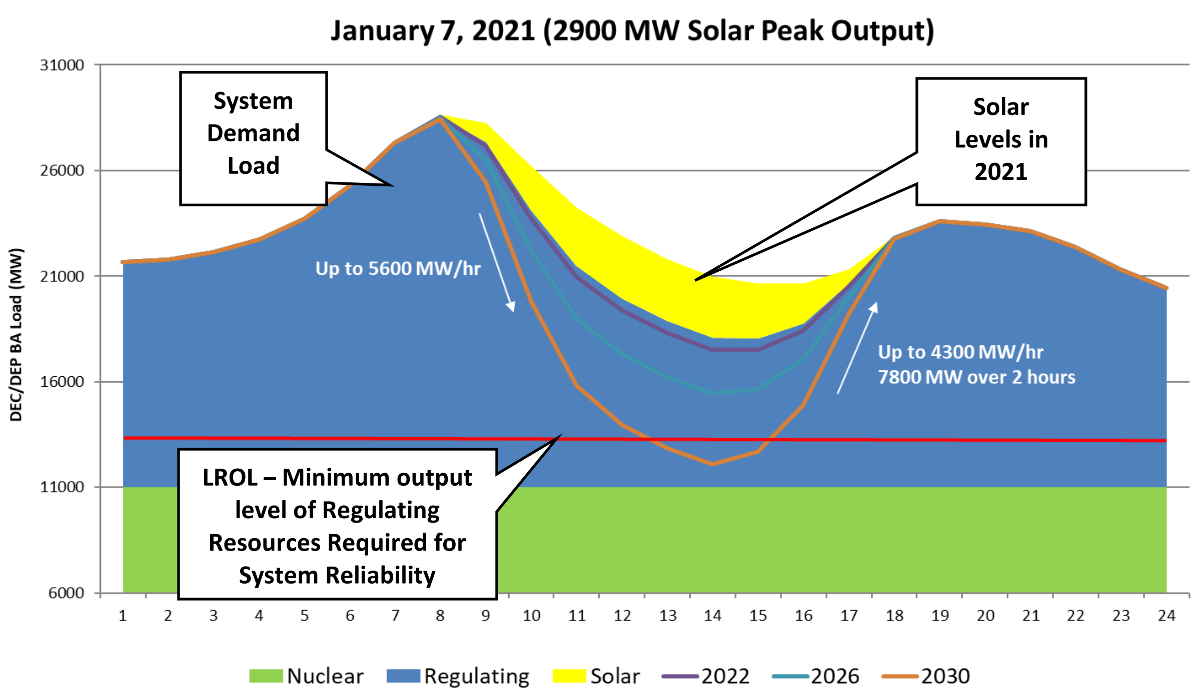


My Figure 3 shows another seven day period in January 2021. January 7, 2021 (blue line) was a blue-sky morning and partly cloudy afternoon in the DEP area with solar output peaking at 2,106 MW at hour 12 (12:00). My Figure 4 presents a combined operational view of the DEP and DEC BAs on January 7, 2021. Viewing Figure 3 and Figure 4 together shows that, this weather resulted in actual peak solar output of approximately 2,900 MW at hour 13 (13:00), when the combined customer demand was 21,816 MW near the mid-day valley hours after the morning peak customer demand of 28,635 MW occurred at hour 8 (8:00).

Roberts Rebuttal Figure 3: DEP Solar Profile 7-Day Period (Jan. 1,– Jan. 7, 2021)



Roberts Rebuttal Figure 4: DEC/DEP Jan. 7, 2021 Resource Stack with Solar



Q. PLEASE DESCRIBE DEP'S OPERATIONAL EXPERIENCE INTEGRATING VARIABLE AND UNCONTROLLED SOLAR GENERATION ON JANUARY 7, 2021.

A. To explain further, Figure 4 presents DEP's system operations perspective on January 7, 2021, with peak demand of more than 28,635 MW and 4,120 MW of solar installed capacity at that time. It shows the morning peak was served only by DEC and DEP load following network resources, with very limited, if any, contribution to peak demand by the solar installed capacity. After the morning peak, the solar generation increases significantly, requiring steep down-ramps of regulating/load following resources in each BA, with increased risk of excess energy, especially in the DEP BA, if it is unable to remove generation fast enough as solar generation injections increase. At the same time, the DEC and DEP BAs must also maintain proper online operating reserves should cloud cover suddenly decrease the solar output such as occurred in the afternoon. This ramp down is accomplished by rapidly reducing network resource output (primarily natural gas generation) in the opposite direction of the solar energy delivery curve. Correspondingly, in the afternoon, as system demand gained, the solar generation dropped off significantly. To balance the system in real time, the BA must rapidly ramp up the output of its regulating/load following resources (primarily natural gas generation) to catch the rising demand and support the evening peak load, while the solar generation is also rapidly dropping off.

Together, Figures 3 and 4 demonstrate the operational limitations and increasing challenges of operating the BAs as installed solar capacity, especially uncontrolled QF solar grows. Figure 4 also highlights that the majority of the solar generation is produced during the mid-day hours when the system has the least need for energy, and therefore increases the risk of operationally excessive energy on the system. Lastly, Figure 4 shows a rapid drop off in solar energy production in the afternoon hours, requiring steep ramping of network resources, and an increased risk of deficit energy on the system if resources are unable to keep pace with increasing demand and the rapidly fading solar generation. This very concern of being able to have sufficient resources to meet net demand as solar output rapidly decreases as the sun goes down was one of the primary causal factors of the summer 2020 rolling blackouts that occurred in California Independent System Operator ("CAISO").[16]

Q. WILL THE GROWING LEVELS OF SOLAR QF ENERGY AND THE ASSOCIATED VARIABLE AND INTERMITTENT NATURE OF SOLAR OUTPUT CHALLENGE FUTURE COMPLIANCE WITH NERC'S RELIABILITY STANDARDS?

A. Yes. Maintaining compliance with mandatory NERC Reliability Standards is critically important and requires the BA to maintain proper generation reserves and to balance demand and resources in real time. The growing levels of variable and intermittent solar energy and instances of operational excess generation associated with solar QFs, as described above, directly impact and challenge the DEC and DEP BA system operators' ability to plan for and assure compliance with NERC's Reliability Standards.

[16] California ISO, California ISO, Final Root Cause Analysis Mid-August 2020 Extreme Heat Wave, at 1 (Jan. 13, 2021), *available at* http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf.

Q. CAN SOLAR PLUS BATTERY STORAGE REPLACE RETIRED COAL GENERATION, AVOID NEW NATURAL GAS GENERATION, AND RELIABLY MEET ESSENTIAL LOAD FOLLOWING AND RESERVE REQUIREMENTS.

A. Not as Witness Lucas's opinion indicates. Today, coal-fired generation is critical during periods of high customer demand to provide the "essential reliability services" of regulating and load following on the DEP and DEC Balancing Authorities. If this generation is not replaced by generation that can provide these same essential reliability services, DEC and DEP system operators will be significantly challenged to comply with NERC's BAL Reliability Standards and reliable electric service for our customers will be threatened.

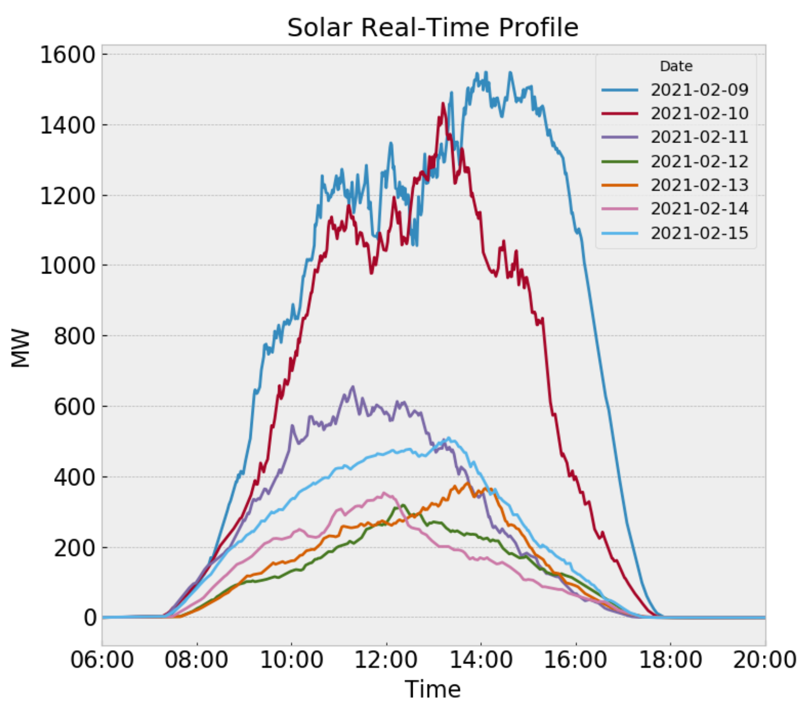
Q. DO YOU BELIEVE PLANNING FOR INCREMENTAL GAS GENERATION IN THE COMPANIES' 2020 IRP SCENARIOS APPROPRIATELY BALANCES ENSURING CONTINUED POWER SUPPLY RELIABILITY, AS REQUIRED BY ACT 62, AND IS CONSISTENT WITH THE COMPANIES' NET-ZERO GOALS?

A. Yes. CCEBA Witness Lucas puts forth the opinion that the incremental gas generation as shown in the Companies' 2020 IRPs base planning scenarios is inconsistent with the Companies' net-zero goals and implies that solar plus 2-hour storage is an adequate substitute.[17] I strongly disagree with this opinion. The 2020 IRPs' scenarios and the associated incremental gas generation additions are consistent with the Companies' net-zero goals because they enable significant near-term coal retirements and provide the necessary regulating capability to integrate a significant amount of variable and intermittent solar. Moreover, Witness Lucas ignores operational realities. My Figures 5

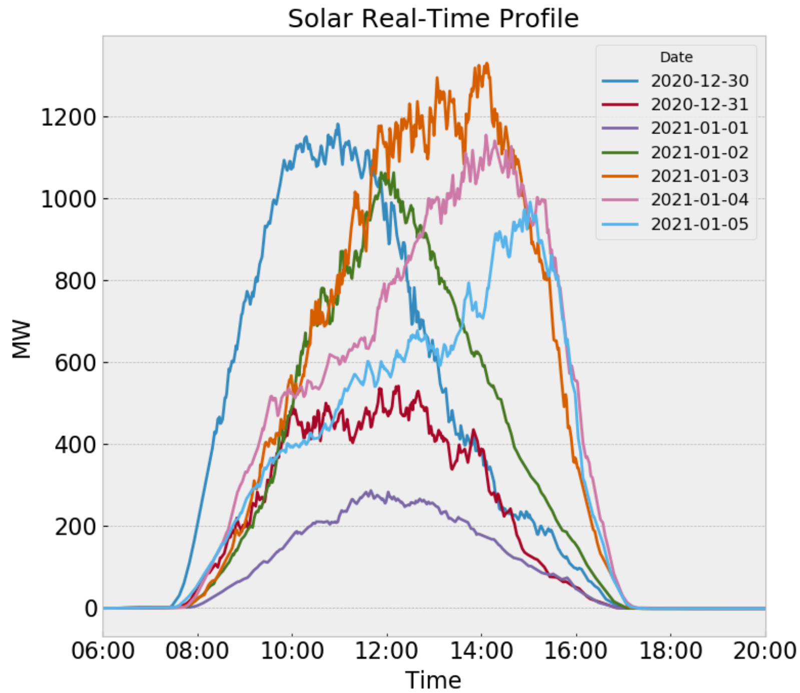
[17] CCEBA Lucas Direct, at 46-47.

and 6 highlight realized winter solar output from installed solar facilities in the DEP BA in South Carolina and North Carolina. Importantly, these figures demonstrate that weather in the Companies' BAs can lead to several consecutive days of low irradiance resulting in low capacity factors for solar output. These low capacity factors would result in insufficient energy to reliably serve customer demand especially if this solar output is the energy that is then being depended on for charging battery storage resources to provide dispatchable capacity. As mentioned earlier in my rebuttal testimony, the capacity factor of the solar fleets interconnected to the DEP BA for seven consecutive days in February 2021 was only 6.06% and only 3.44% for five consecutive days. For comparison, Figure 7 is shown to represent the solar output on a blue-sky day, January 23, 2021 (purple line) compared to the extreme variability across the six prior days.

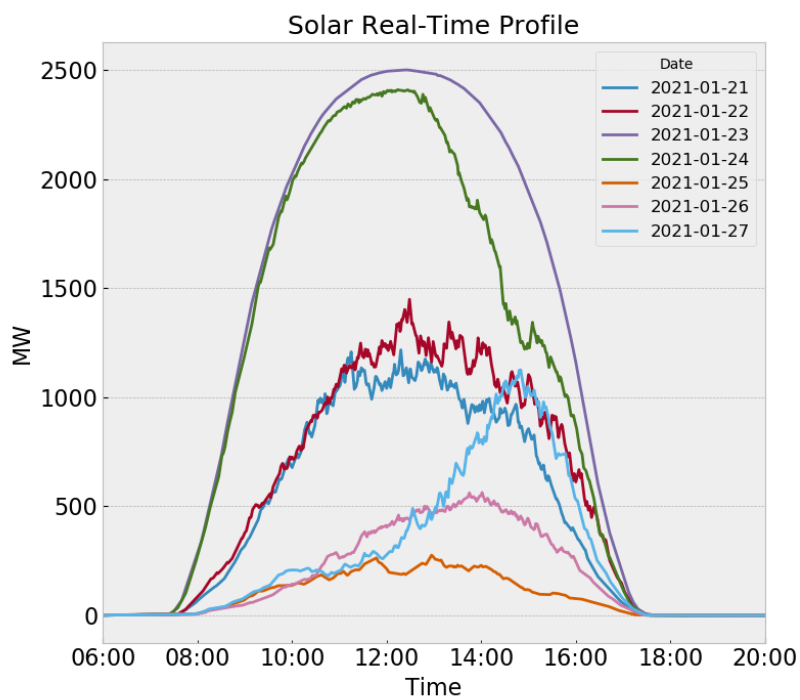
Roberts Rebuttal Figure 5: DEP Low Solar Capacity Factor 7-Day Period



Roberts Rebuttal Figure 6: DEP Low Solar Capacity Factor 7-Day Period



Roberts Rebuttal Figure 7: DEP Solar Output for 7-Day Period with Blue-sky Day

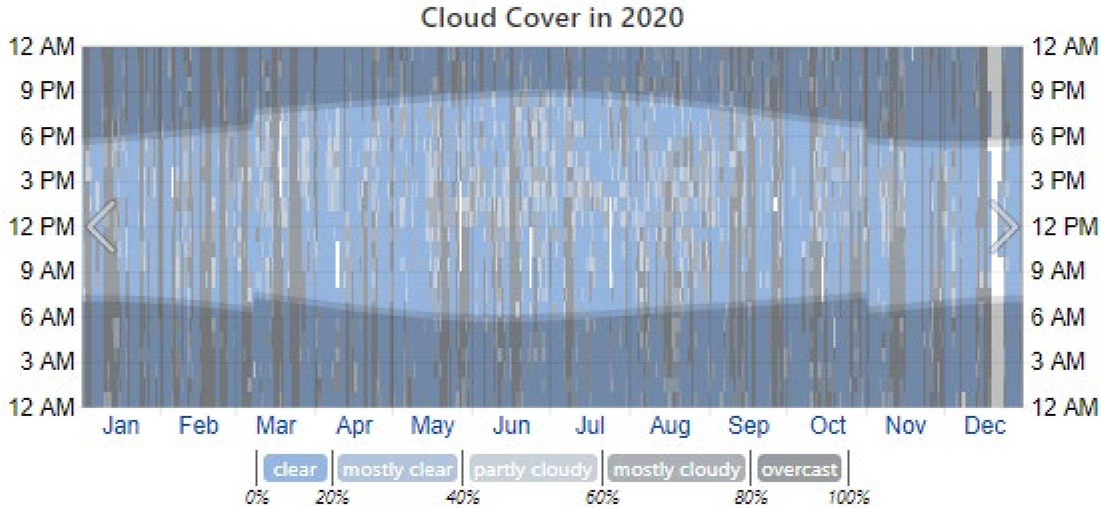


I present these figures to highlight for the Commission that with such uncertainty as to the solar production that will be realized on any given day and during any given week, counting on such production for serving customers' electric demand and for charging battery storage is not dependable and overreliance on these technologies could jeopardize DEC's and DEP's ability to provide reliable electric service to our customers.

Q. WHY IS CLOUD COVER SO IMPORTANT TO UNDERSTANDING THE CHALLENGES OF SOLAR AVAILABILITY AND RELIABILITY IN THE CAROLINAS, ESPECIALLY DURING WINTER PERIODS WHEN THE COMPANIES EXPERIENCE THEIR GREATEST LOSS-OF-LOAD RISK?

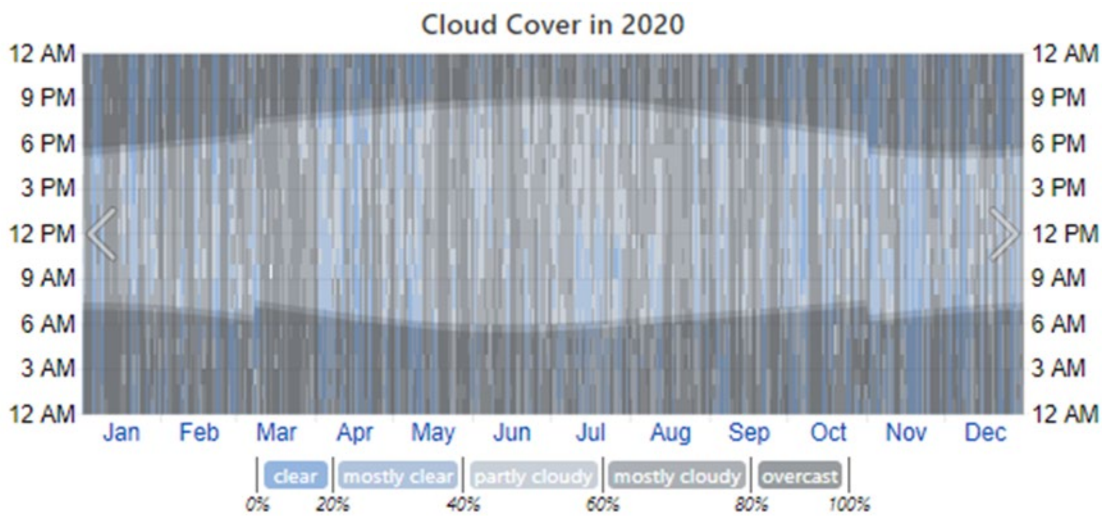
A. Cloud cover data, which is directly correlated with the amount of irradiance available as the fuel for solar panels to generate output, reflects the day-to-day, week-to-week variability, and the unreliable nature of solar output in the Carolinas. Figure 8 and Figure 9 reflect the 2020 cloud cover for Columbia, South Carolina and Raleigh, North Carolina. These cloud cover charts reflect the volatile nature of irradiance in the Carolinas. In contrast, Figure 10 presents the cloud cover in Las Vegas, Nevada represented in where realized solar capacity factors is much higher and solar output is more predictable and dependable from day-to-day, week-to-week.

Roberts Rebuttal Figure 8: Columbia, SC 2020 Cloud Cover[18]



The hourly reported cloud coverage, categorized by the percentage of the sky covered by clouds.

Roberts Rebuttal Figure 9: Raleigh, NC 2020 Cloud Cover[19]



The hourly reported cloud coverage, categorized by the percentage of the sky covered by clouds.

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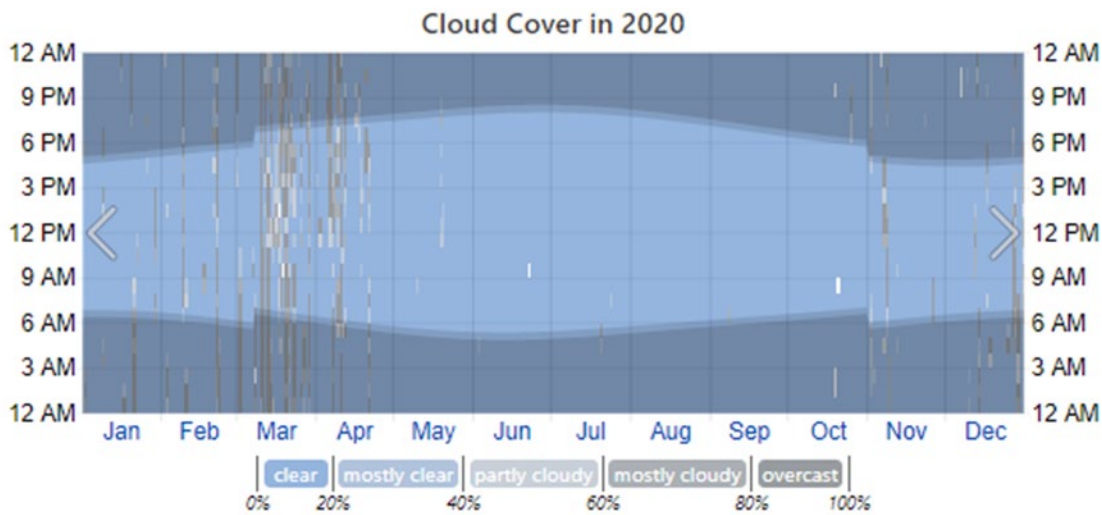
[18]Historical Weather during 2020 at Columbia Owens Downtown Airport, South Carolina, United States - Weather Spark, https://weatherspark.com/h/y/146892/2020/Historical-Weather-during-2020-at-Columbia-Owens-Downtown-Airport-South-Carolina-United-States.

[19]Historical Weather during 2020 at Raleigh-Durham International Airport, North Carolina, United States - Weather Spark, https://weatherspark.com/h/y/146992/2020/Historical-Weather-during-2020-at-Raleigh-Durham-International-Airport-North-Carolina-United-States.

Roberts Rebuttal Figure 10: Las Vegas, NV 2020 Cloud Cover[20]



The hourly reported cloud coverage, categorized by the percentage of the sky covered by clouds.

Q. ARE YOU AWARE OF RECENT OPERATIONAL EXPERIENCE IN OTHER PARTS OF THE COUNTRY WHERE CLOUD COVER HAS AFFECTED SOLAR AVAILABILITY AND CONTRIBUTED TO ADVERSE RELIABILITY EVENTS?

A. Yes. Even in areas of California that experience some of the highest irradiance in the U.S., afternoon cloud cover and its impacts on solar production were mentioned in the root cause analysis report as a contributing cause of the August 15, 2020 rotating blackouts that occurred between 6:28 and 6:48 PM PST.

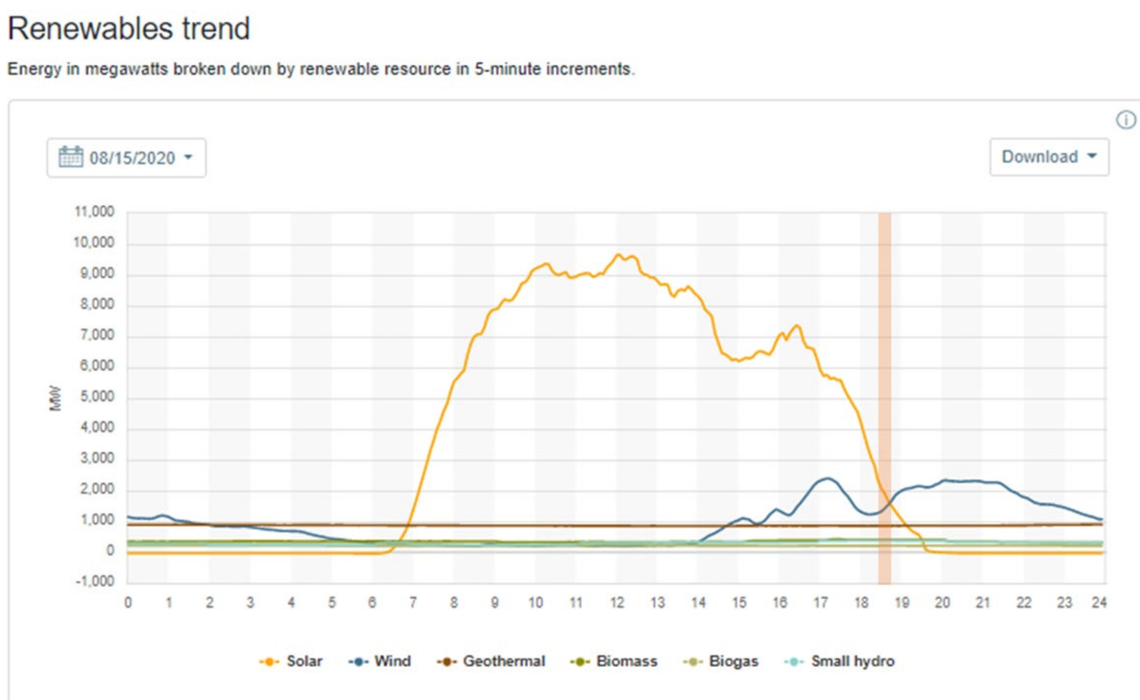
> In addition, solar generation was reduced by high clouds from a storm covering large parts of California on August 15 and smoke from active fires on both days. Wind generation was impacted by storm patterns through the peak and net demand peak period on August 15, which caused a decline in actual production of 1,200 MW between 5:12 p.m. and 6:12 p.m. before increasing again closer to 7:00 p.m.[21]

[20] Historical Weather during 2020 at North Las Vegas Air Terminal, Nevada, United States - Weather Spark, https://weatherspark.com/h/y/145434/2020/Historical-Weather-during-2020-at-North-Las-Vegas-Air-Terminal-Nevada-United-States.

[21] *See* California ISO, Final Root Cause Analysis Mid-August 2020 Extreme Heat Wave, at 50 (Jan. 13, 2021), http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf.

My Figure 11 shows the variability of solar and wind resources in the CAISO on August 15, 2020.

Roberts Rebuttal Figure 11: CAISO Renewable Output for Aug. 15, 2020



Q. DOES BATTERY STORAGE HAVE A PLACE IN THE DEC AND DEP IRP PORTFOLIOS WHERE SYSTEM RELIABILITY AND NERC STANDARD COMPLIANCE CAN BE MAINTAINED?

A. Yes. As shown in the DEC and DEP IRP summary tables, between 1,050 and 7,400 MW of incremental storage is reflected for the six portfolios. However, storage does require energy to store to be useful and for each MWh of energy stored, only 0.75 to 0.85 MWh is returned to the system. As I have discussed and demonstrated, solar output in the Carolinas is not reliable as an energy source for storing energy during winter months when the Companies experience their greatest loss of load and reliability risks, unless constructed in extreme excess which would be costly and result in more challenges for the system operator with excess energy and thus, necessitate more curtailments.

Another consideration the Companies continue to analyze is that storage is limited in duration or MWh available to discharge into the power system. This is especially the case for 2-hour duration batteries, as recommended by CCEBA Witness Lucas. For example, a 50 MW, 2-hour duration battery can discharge 100 MWh of electrical energy into the system. Once the 100 MWh is discharged, the battery storage has to be recharged with 118 MWh of electrical energy prior to being useful as a 50 MW, 2-hour duration capacity resource again. This charge/discharge cycle is vastly different as compared with a 100 MW gas-fired combustion turbine that once started, can produce electricity anywhere in between its minimum and maximum capabilities for as long as needed. This type of reliable, dependable, and dispatchable resource is critical to being able to serve extended high customer demand and to regulate around the variability and intermittency of solar output.

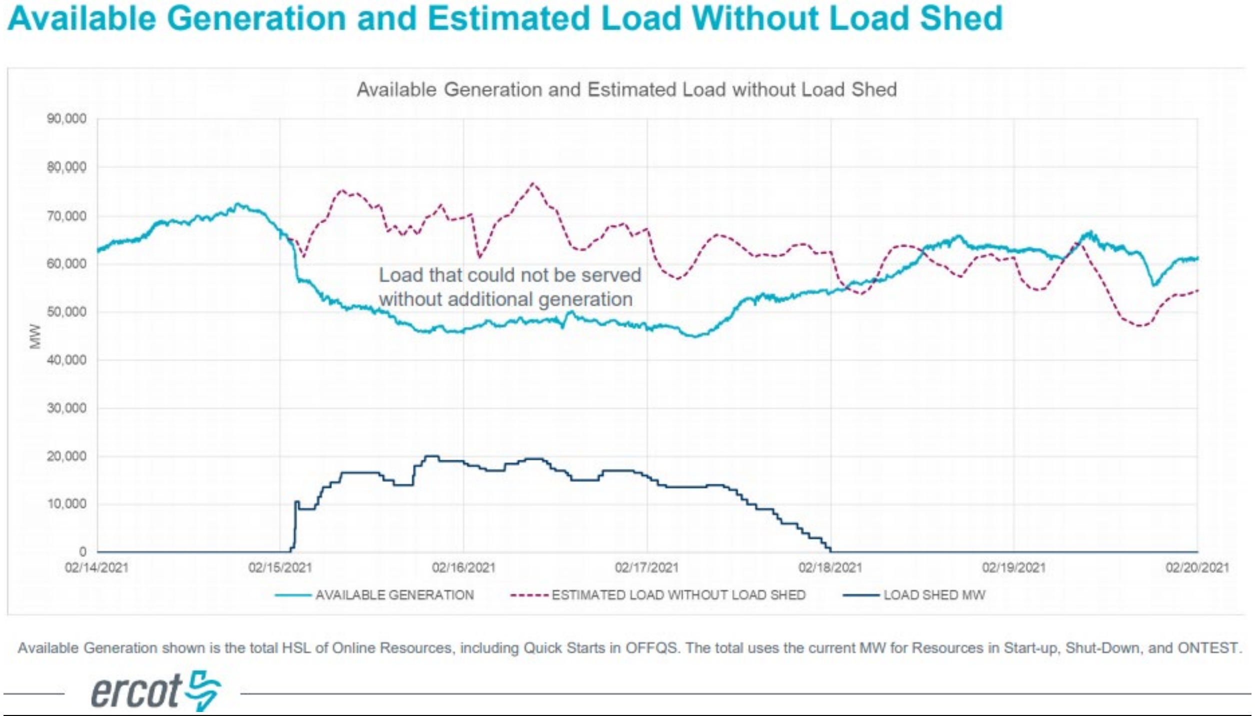
Q. BASED ON YOUR RESPONSE TO THE PRIOR QUESTION, WOULD YOU CONCLUDE THAT RELIANCE ON SOLAR PLUS BATTERY STORAGE IS LESS RISKY AS COMPARED WITH NEW GAS GENERATION?

A. No. From my perspective as a system operator, I recognize that every option considered in every scenario in the IRPs carries its own risks. However, carried to a logical conclusion, the recommendations of CCEBA would lead to an over-reliance on purchased, non-dispatchable solar for which the output is variable and intermittent, and, based on the Companies' growing operational experience, unreliable as a resource for serving winter peak demand or for charging battery storage for serving winter peak demand.

As stated previously, incremental storage, if under system operator control, is beneficial where excess energy from solar is available to store and can then be used to assist the system operator with lessening the burden on load following /regulating resources meeting steep ramps created by solar's non-conforming output and thus providing resource assurance to help meet NERC Reliability Standard requirements. However, there would be scenarios such as periods of consecutive days with low solar capacity factors and high winter customer demand where storage, if being heavily relied upon for a capacity resource would be unreliable. Indeed, looking at the recent ERCOT extreme cold weather event, as reflected in Figure 12, there were approximately 72 hours where ERCOT was shedding firm load and there would have been no energy available to store.[22]

[22] Texas Legislative Hearings: Senate Business and Commerce Committee House Joint Committee on State Affairs and Energy Resources Presentation by Bill Magness, President & Chief Executive Officer ERCOT, February 25, 2021, at slide 15, http://www.ercot.com/content/wcm/lists/226521/Texas_Legislature_Hearings_2-25-2021.pdf (last visited March 17, 2021).

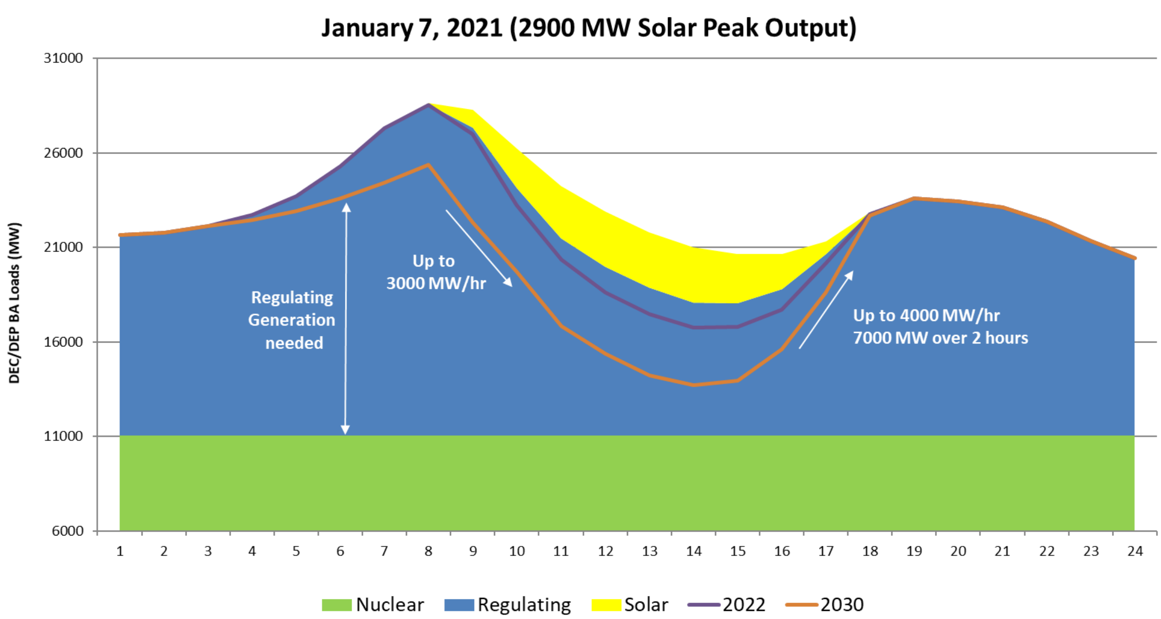
Roberts Rebuttal Figure 12:
ERCOT 72-Hour Available Generation and Firm Load Shed



Q. PLEASE DESCRIBE HOW INTEGRATING SOLAR PLUS BATTERY STORAGE COULD ASSIST BUT PERHAPS NOT SOLVE FOR RELIABILITY AND RESOURCE ASSURANCE CHALLENGES BASED UPON THE REAL WORD EXAMPLE YOU DISCUSSED EARLIER FROM JANUARY 7, 2021.

A. Figure 13 reflects the same January 7, 2021 load shape with an orange line showing the impacts of 11,000 MW of solar and 3,000 MW of storage reflecting how storage can be used to lessen the impact of midday excess energy and reduced net demand ramping. However, I would like to point out this is only accomplished if there was adequate energy to store and the blue area under the orange line (representing customer energy demand) must be served with adequate baseload/regulating/load following resources including maintaining proper reserves should a contingency occur such as generation tripping off-line. At its peak, over 14,300 MW of baseload/ regulating/load following resources would be needed in the DEC BA and DEP BA to meet combined peak loads of 28,635 MW. Considering the extreme cold weather period of January 2 through 8, 2018 when DEC BA and DEP BA combined peak loads topped 36,000 MW for 3 mornings, this baseload/regulating/load following resources plus contingency reserves requirement would increase by approximately 7,000 MW to 21,300 MW. If these resources are not planned appropriately and are not adequate to ensure needed dependable and dispatchable capacity is available every second, minute, hour and day of the year to meet this energy need, the resulting resource/demand imbalance can cause unscheduled power flows and impact system frequency and cause NERC reliability risks for our customers.

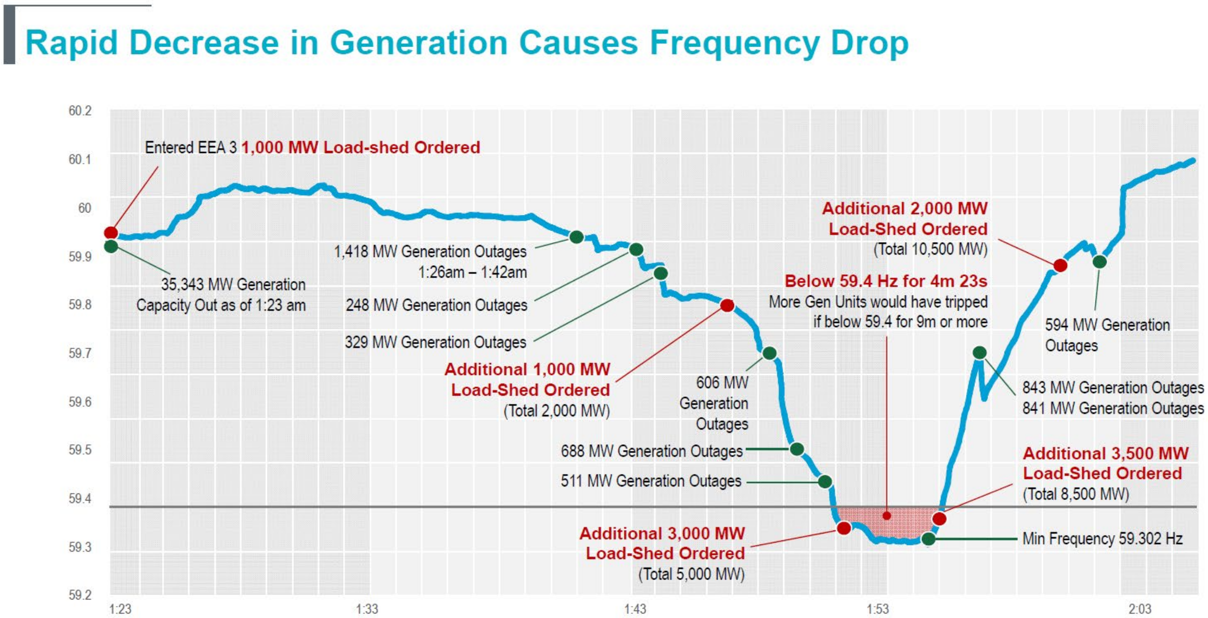
Roberts Rebuttal Figure 13: Jan. 7, 2021 Illustrative Experience with Increased Solar/Battery Storage Additions



Q. CAN YOU PROVIDE A REAL WORLD EXAMPLE OF WHAT CAN HAPPEN TO SYSTEM FREQUENCY IF THERE ARE NOT ENOUGH RESOURCES TO SERVE CUSTOMER DEMAND?

A. The best example of the impact on frequency from not having enough resources to serve the customer demand is the recent February 15, 2021 ERCOT load shedding event. My Figure 14 shows the impact to system frequency in ERCOT on the morning of February 15, 2021 due to not having enough resources for serving demand. When a power system does not have adequate available resources to serve customer demand, at first, kinetic energy is removed from synchronous generation's rotating masses (generator rotors rotating at a given revolutions per minute ("RPM")) resulting in declining frequency. Next, generators attempt to automatically release more energy into the turbine (either additional steam or fuel flow) to arrest, but not restore the declining rotor speed. Given time to do so, system operators can return system frequency to the normal range by increasing on-line unloaded generation, starting additional fast start generation, interrupting service to interruptible customers, or shedding firm customer load. In ERCOT's case, on February 15, 2021, the system operators had already exhausted available generation and DSM and demand response resources, and generation was continuing to succumb to forced outages in the sub-freezing temperature weather. This imbalance between resources and customer demand continued to worsen over a ten-minute period and resulted in frequency declining to 59.302 hertz.

Roberts Rebuttal Figure 14: ERCOT Feb. 15, 2021 Low Frequency Event



This resource/demand imbalance on the ERCOT system occurred at 1:50 AM, or approximately 5.5 hours before ERCOT's forecasted peak demand was supposed to occur.

In response to these events, Bill Magness, then-ERCOT President and CEO, indicated in a statement after the significant frequency decline event that the system operators "avoided a catastrophic blackout" by restoring resource/demand balance through shedding firm load.

> The fundamental decision that was made in the middle of the night, at 1 a.m. Monday, to have the outages imposed was a wise decision by the operators we have here," ERCOT President & CEO Bill Magness said during a midday virtual briefing with the media, who said making the call may have "avoided a catastrophic blackout.[23]

[23]Dillon Collier et al., 'Avoided a catastrophic blackout': ERCOT head defends decision to shed power from grid, KSAT.com (Feb. 17, 2021), *available at* https://www.ksat.com/news/local/2021/02/17/avoided-a-catastrophic-blackout-ercot-head-defends-decision-to-shed-power-from-grid/.

These recent events highlight the need to plan for and ensure adequate resources are available 24x7 to ensure resource/demand balance and compliance with NERC Reliability Standards.

Q. HOW DOES THE ERCOT EVENT AND THE PREVIOUS AUGUST 2020 CAISO EVENT YOU MENTIONED RELATE TO THIS PROCEEDING?

A. The August 2020 CAISO event Root Cause Analysis Report identified that 1) resource adequacy and planning targets were insufficient for the extreme heat wave the CAISO area was experiencing and 2) with transitioning to greater penetrations of variable, intermittent and non-dispatchable renewable energy for purposes of meeting clean energy goals, planning targets did not ensure sufficient resources that can be relied upon to meet demand in the early evening hours.[24]

The ERCOT event was complex and just prior to and during the event, caused by multiple inter-related generation resource and fuel factors, not just an intermittent renewables issue. However, the February 2021 ERCOT event also reflects a lack of effective planning, ensuring resource adequacy and resource assurance, and risk assessment and management. From a system operator's perspective, prudent planning and operations are needed to ensure the Companies are not subject to these risks in real time. This prudent planning includes acknowledgement that there are and can be in the future, consecutive days in the winter season in the Carolinas where solar production capacity factors can be in the single digit percentages, sometimes low single digits, and this is a risk that has to be considered to avoid the CAISO or ERCOT type of events.

[24] California ISO, California ISO, Final Root Cause Analysis Mid-August 2020 Extreme Heat Wave, at Page 1 (Jan. 13, 2021), *available at* http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf (last visited March 17, 2021).

IV. RESPONSE TO VOTE SOLAR WITNESS FITCH'S CLIMATE RISK ANALYSIS

Q. DOES VOTE SOLAR WITNESS FITCH CONSIDER RELIABILITY RISKS AS PART OF HIS CARBON STRANDING AND CLIMATE RISK REPORT?

A. No. Vote Solar Witness Fitch's Carbon Stranding and Climate Risk Report focuses almost exclusively on the purported financial risk of stranded assets for natural gas plants, which is addressed by Witness Snider and Witness Santoianni. However, he does not address the risks, including reliability and operational risk as well as financial risk, of leaning too heavily on any single type of generation if the Companies retire their significant coal fleets as planned and then do not build dispatchable gas-fired capacity as part of their generation portfolios. Indeed, he admits in discovery that he did not focus on reliability risks of not meeting customer load in his evaluation of the climate risks facing DEC and DEP, and asserts, "Mr. Fitch expects that the Companies will manage reliability risks just as they manage all relevant business risks, in line with prudent business management."[25]

The Companies' 2020 IRPs are precisely designed to prudently manage reliability risks in order to ensure power supply reliability for our customers. As I discuss in response to CCEBA Witness Lucas, the Companies' prudent planning to manage reliability risks includes ensuring dependable, firm, dispatchable incremental gas generation resources with backup fuel located at the site are available to ensure reliable electric service for our customers and for meeting the reliability requirements in NERC's standards for many years to come.

[25] *See* Roberts Rebuttal Exhibit 1, Vote Solar Response to DEC and DEP Interrogatory Request 1-9.

Q. HAS NERC RECENTLY EMPHASIZED THE IMPORTANCE OF TRANSITION GENERATION WITH RESPECT TO MAINTAINING RELIABILITY WITH A CHANGING RESOURCE MIX?

A. Yes. As I highlighted above the NERC President and CEO, Mr. James Robb, testified just days ago to the U.S. Senate E&NR Committee, and highlighted the critical role current and new gas generation resources will play with integrating more variable generation resources through providing "bulk energy" and "balancing energy" as traditional baseload generation plants are retired.

> "The bulk power system is undergoing major transformation that must be understood and planned for to preserve reliability. A rapidly changing generation resource mix is driving this transformation. Traditional baseload generation plants are retiring, while significant amounts of new natural gas and variable generation resources are being developed. During this transition, natural gas-fired generation is becoming more critical to provide both "bulk energy" and "balancing energy" to support the integration of variable resources."[26]

Mr. Fitch fails to consider that natural gas-fired generation is, in fact, becoming more critical to preserve reliability as the Companies are transitioning their generation resource mix.

Q. DID YOU ALSO REVIEW THE UNDERLYING MODELING AND INPUTS TO WITNESS FITCH'S CARBON STRANDING AND CLIMATE RISK REPORT?

A. Yes. Witness Fitch recently provided in discovery the work papers and code developed in the Python-based model that he used to perform his analysis and to develop the Carbon Stranding and Climate Risk Report for ETI.[27] Companies' personnel with significant

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[26] James R. Robb, North American Electric Reliability Corporation, Testimony Before United States Senate Committee on Energy and Natural Resources, Full Committee Hearing on the Reliability, Resiliency, and Affordability of Electric Service (March 11, 2021), *available* at https://www.energy.senate.gov/services/files/EB1D7E02-BC93-4DFF-A6A9-002341DA34CF.

[27] *See* Vote Solar Response to DEC's and DEP's First Set of Request for Production of Documents, 1-6, 1-9.

expertise in Python programming have reviewed the input files, data files, and code Witness Fitch used to perform his climate risk analysis.

Q. WHAT WERE THE RESULTS OF THIS REVIEW?

A. This review revealed that Witness Fitch relied upon numerous inaccurate assumptions, flawed model construction, and incorrect inputs, and thus his analysis and conclusions should not be given any weight by the Commission in these proceedings. First, Witness Fitch's analysis assumes that recent 2016-2018 capacity factors of fossil generation units are indicative of future capacity factors, a false assumption. With future shadow pricing reflecting a carbon policy, these capacity factors would be much lower, resulting in lower CO_2 emissions. Second, Witness Fitch assumes emission factors for Belews Creek Units 1 and 2, Marshall Units 3 and 4, and Cliffside Unit 6 indicating that they will use coal as the sole fuel up through their respective retirement dates. The DEC IRP identifies Belews Creek 1 and 2 and Cliffside 6 as dual fuel units in the base case portfolios.[28] In addition Marshall 3 and 4 have been converted to dual fuel units as well. Considering all of these coal units being converted to dual fuel operations, the emissions factors that Witness Fitch uses are incorrect and result in overstating the future CO_2 emissions from these generators. Lastly, as addressed by DEC/DEP Witness Snider, there is no indication given in the 2020 IRPs that the Companies will—at any cost and risk to customers—pursue a linear approach to the goal of net zero carbon emissions as Witness Fitch assumes in his analysis. This fact is clearly seen with the different pathways presented in the IRPs.[29] For these reasons, the results presented in Witness Fitch's Carbon Stranding and Climate Risk Report, are not

[28] See DEC IRP, at 19, 21.
[29] See DEC IRP, at 8.

credible and should not be relied upon by the Commission.

Q. WHAT IS THE KEY TAKEAWAY THAT YOU WANT TO OFFER THE COMMISSION AS THEY CONSIDER YOUR SYSTEM OPERATOR'S PERSPECTIVE IN THIS INTEGRATED RESOURCE PLANNING PROCEEDING?

A. In evaluating whether the Companies' 2020 IRPs are the most reasonable and prudent means of meeting DEC's and DEP's future energy and capacity needs, I think it is important to reemphasize for the Commission that the ultimate purpose of the IRPs and the focus of these proceedings is to provide the "means of meeting energy and capacity needs."[30] Through my rebuttal testimony, I have attempted to provide a system operator's perspective in response to the testimony and recommendations of CCEBA and Vote Solar and to show how a resource plan heavily laden with variable, intermittent solar resources, without incremental dependable, dispatchable generation, is not reliable, even when augmented with battery storage. As addressed by Witness Snider, the Companies' 2020 IRPs take unprecedented steps to analyze and plan for integrating solar and other clean energy technologies during the IRPs' 15-year planning period. However, a firm, dispatchable incremental resource such as gas generation is needed in order to take the steps in the 2020 IRPs to retire coal generation and bridge us to the future where new technology firm, dispatchable resources are available to consider for meeting "energy and capacity needs" and decarbonization policy. I am also pleased to see Act 62's focus on ensuring power system reliability as a factor to be considered in these proceedings and the Companies will continue to analyze and study the complex new operational challenges

[30] S.C. Code Ann. § 58-37-40(C)(2).

associated with transitioning our generating fleets and to prudently reliably plan and operate our systems to meet customers' capacity and energy needs.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes.